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**Clasen et al.**

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(54) **BANDWIDTH UPGRADE  
RECOMMENDATION**

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- (52) **U.S. Cl.**  
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- (58) **Field of Classification Search**  
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See application file for complete search history.

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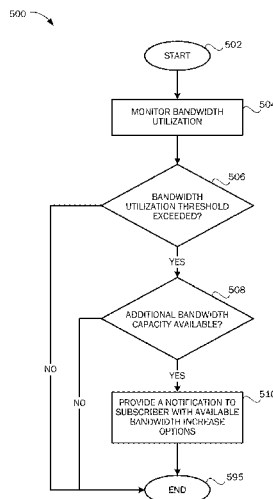
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(57) **ABSTRACT**

A determination of a minimum data transfer rate needed to effectively perform a data transfer activity is provided. If the minimum data transfer rate needed to effectively perform the activity is greater than the amount of bandwidth available according to an associated subscription tier, a notification may be provided to a subscriber that a bandwidth adjustment is available and may be desirable for a better quality experience of the data transfer activity. The notification may be in the form of a text message, an email, a pop-up window, or a user interface control, and may include a selectable functionality, which when selected, may send a request to adjust the amount of bandwidth available to the subscriber.

**18 Claims, 8 Drawing Sheets**



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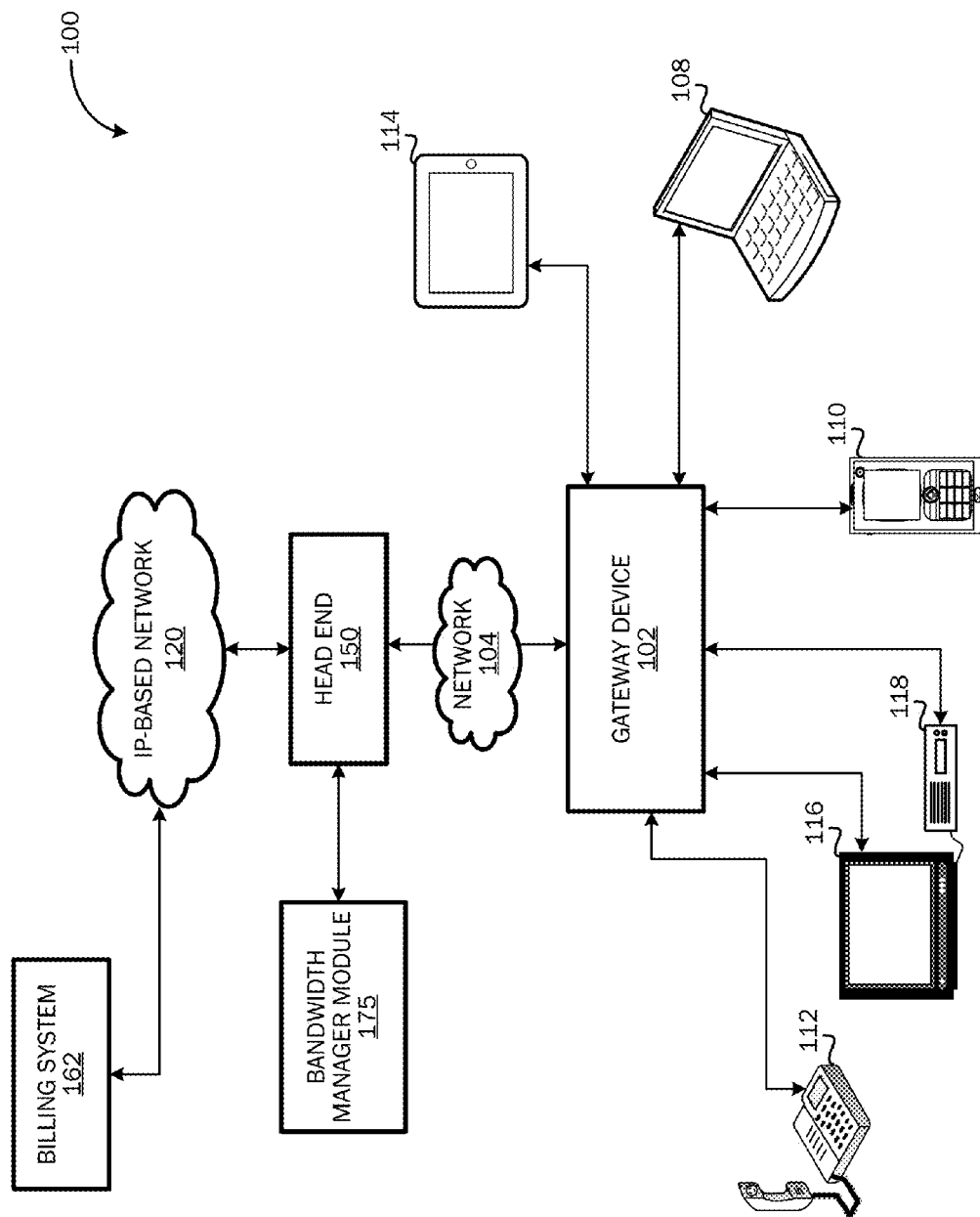


FIG. 1

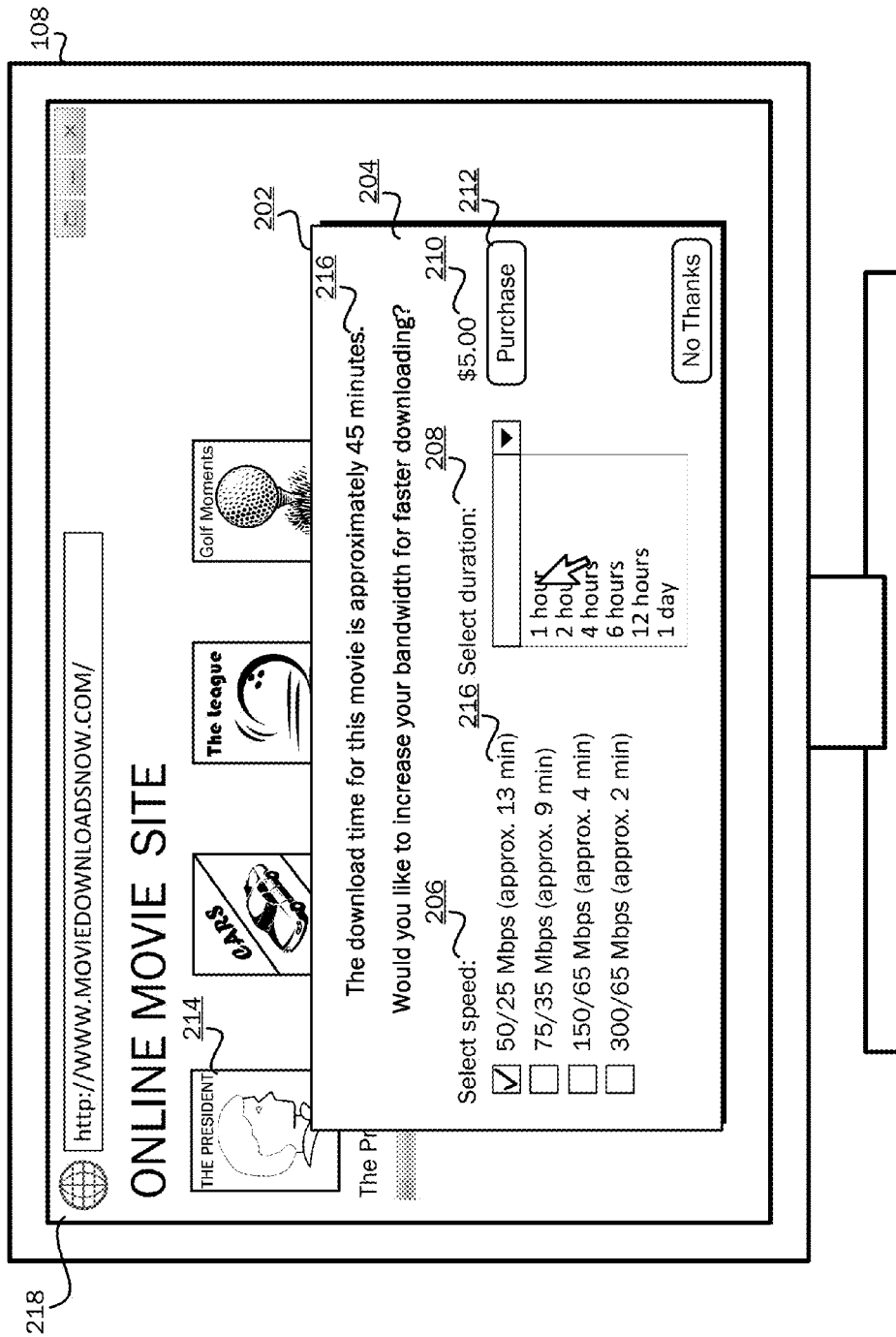


FIG. 2

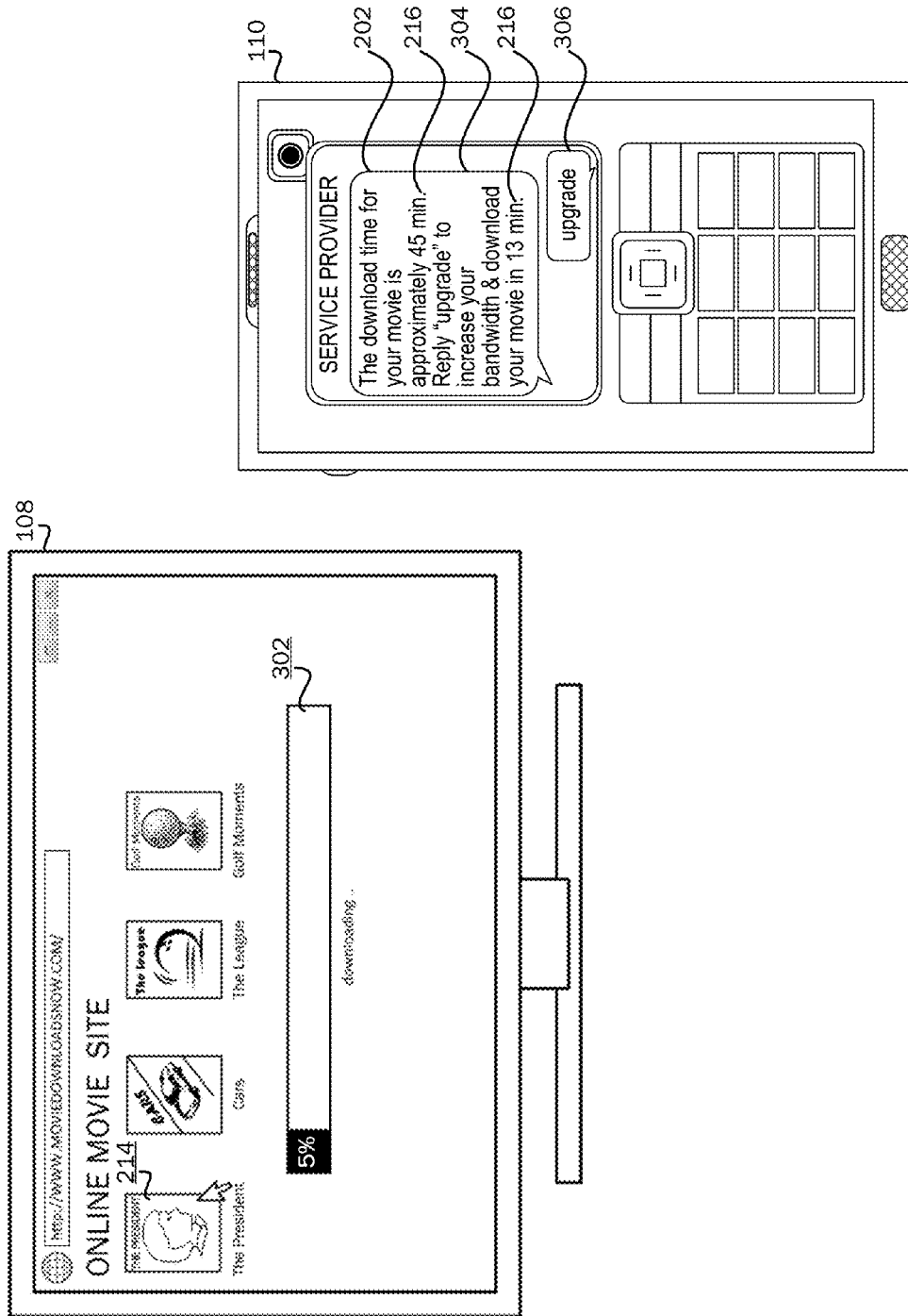
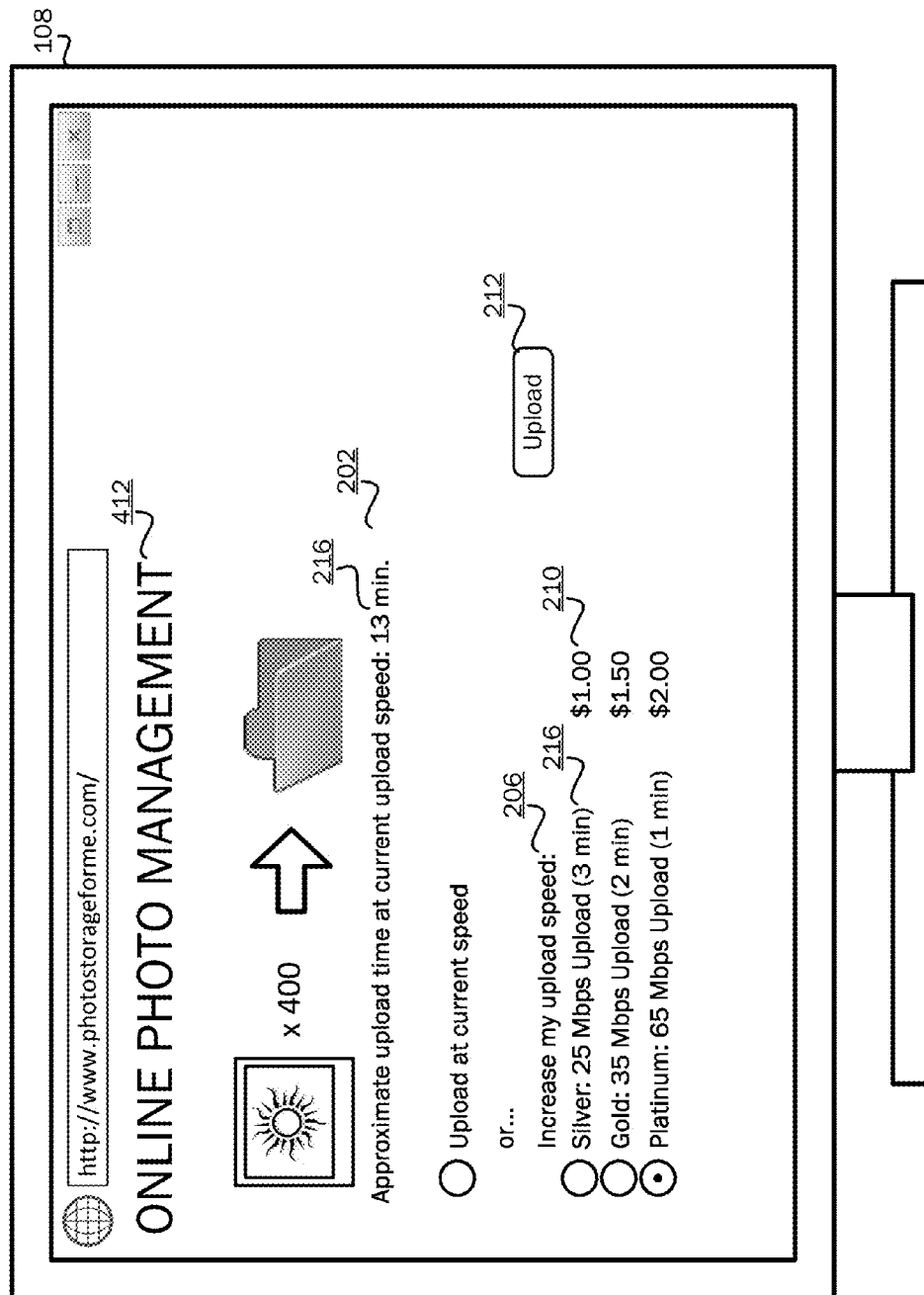


FIG. 3



**FIG. 4**

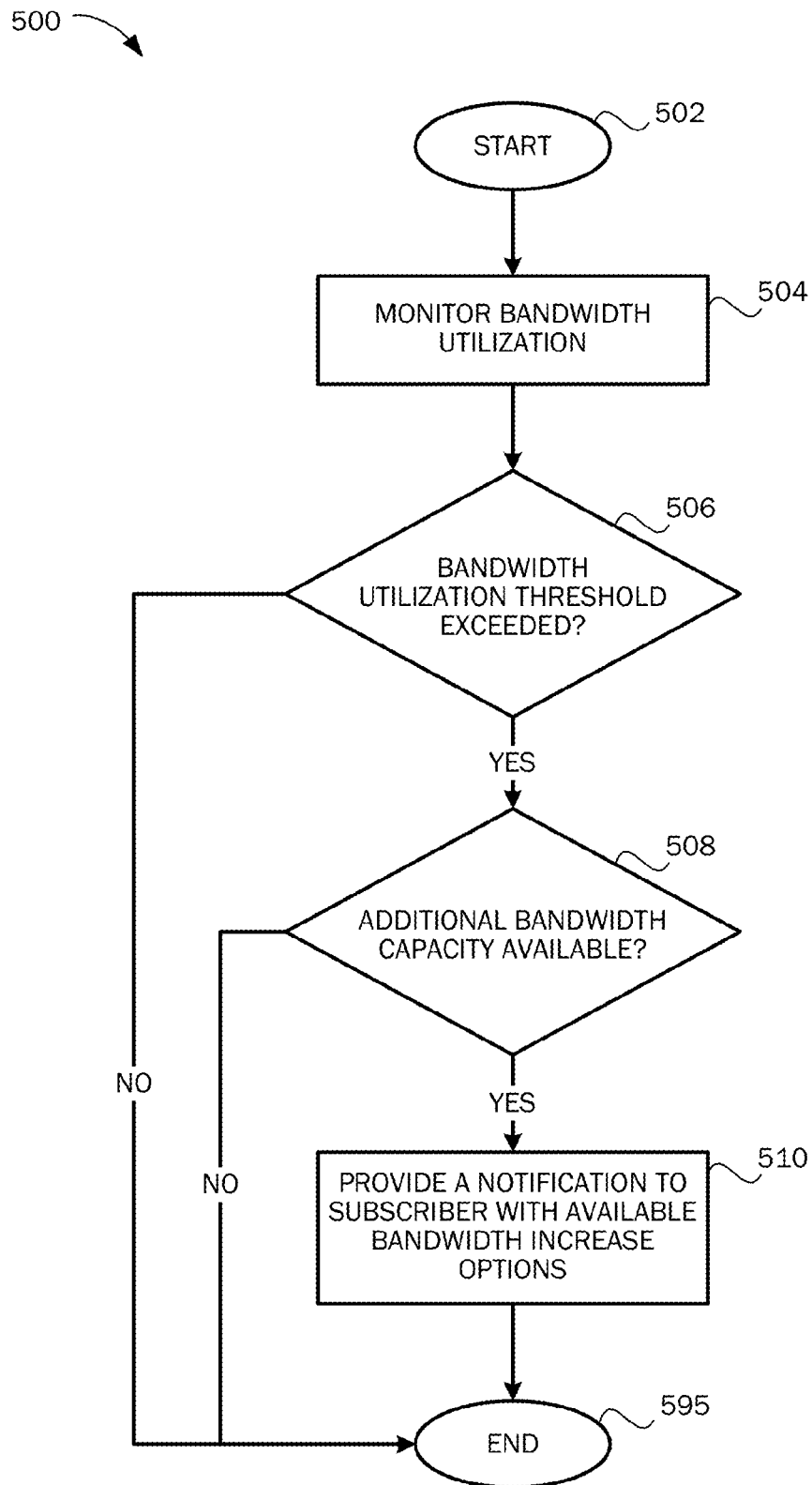


FIG. 5

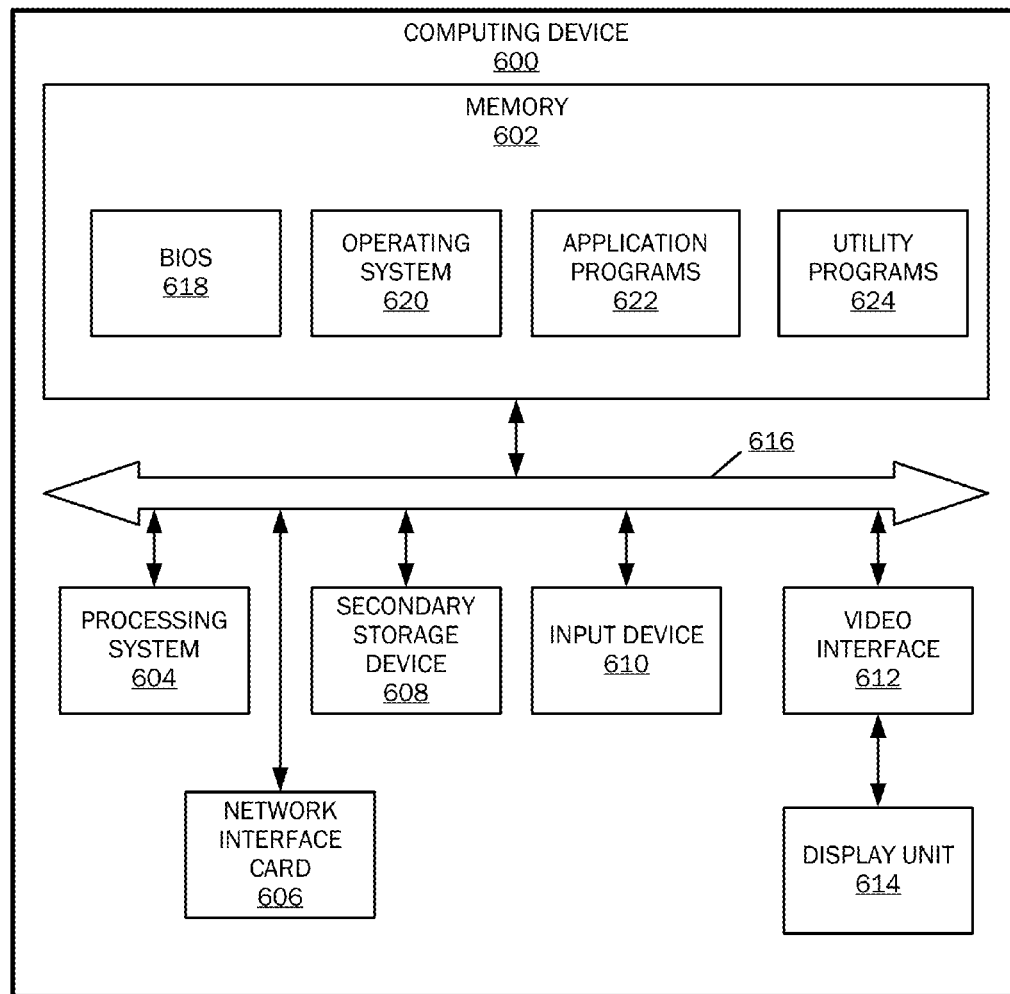
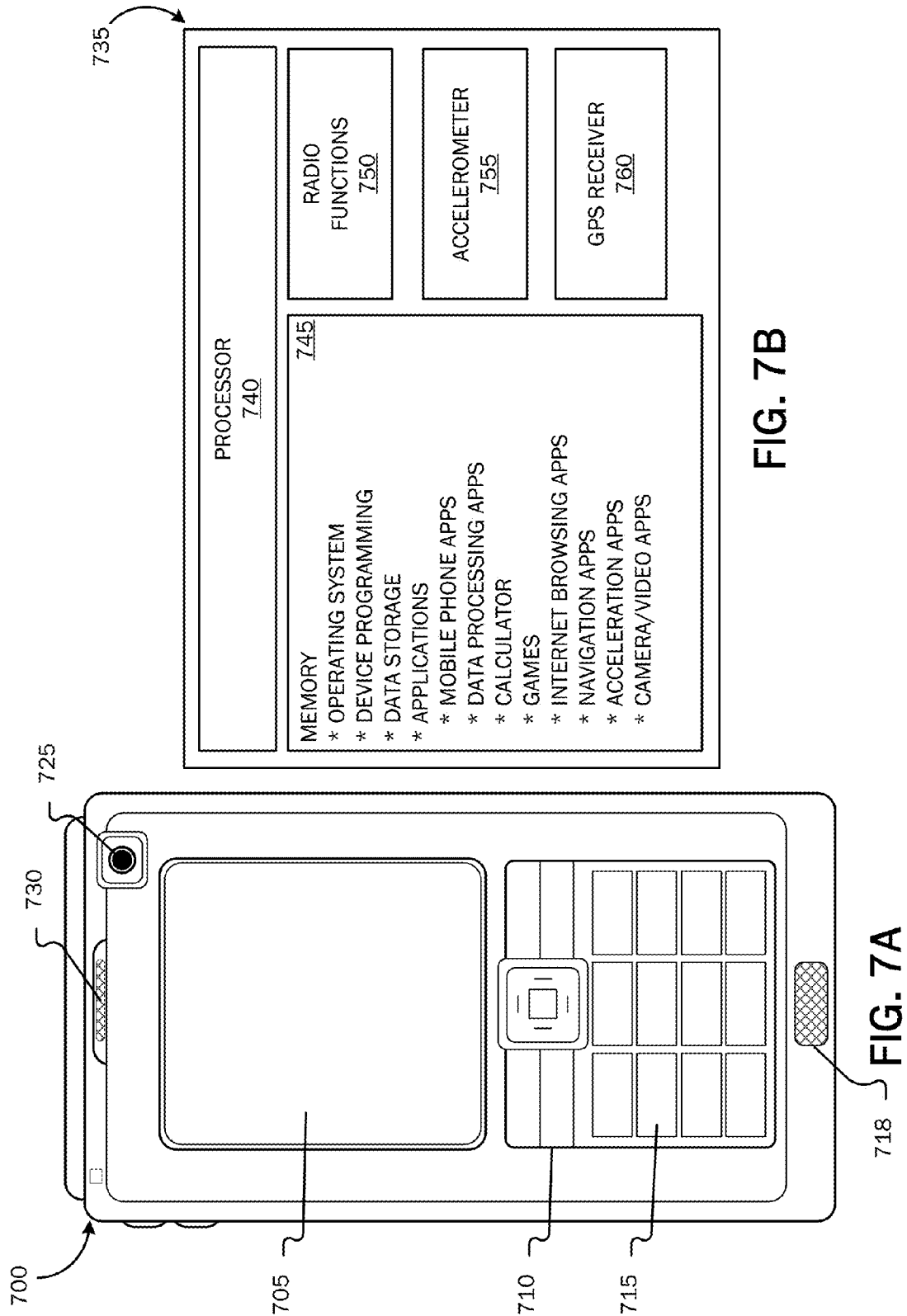


FIG.6





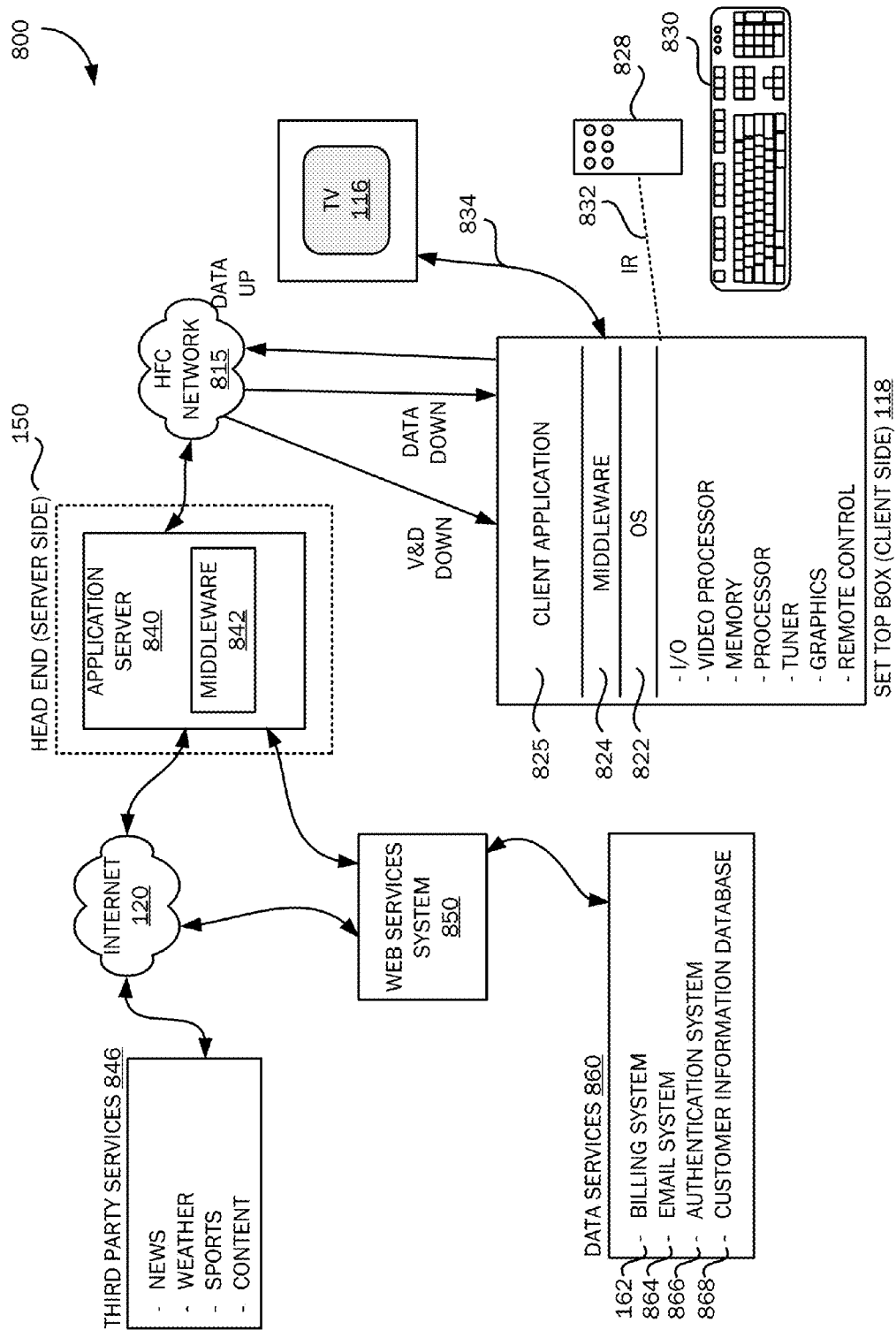


FIG. 8

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## BANDWIDTH UPGRADE RECOMMENDATION

### CROSS REFERENCE TO RELATED APPLICATIONS

This application is related to U.S. patent application, Ser. No. 13/681,389, titled "Bandwidth Upgrade Override," filed on Nov. 19, 2012, the entirety of which is incorporated by reference herein.

### BACKGROUND

Access to a computer network system, such as the Internet, may be provided by Internet service providers (ISPs) to subscribers. Internet access may be provided to subscribers via different technologies (e.g., cable television (CATV), integrated services digital network (ISDN), digital subscriber line (DSL), etc.) at various data transfer rates according to various subscription tiers. A bandwidth amount or a data transfer rate associated with a subscription tier may be one determinant of subscription price such that a subscription tier with a higher amount of bandwidth or a higher data transfer rate may cost more than a subscription tier with a lesser amount of available bandwidth or a lower data transfer rate. For example, a subscriber who tends to be a light user and uses his Internet service for less bandwidth-intensive activities (e.g., checking emails, skimming news headlines, etc.) may choose a subscription tier with a lesser data transfer rate or bandwidth amount so as to not pay for capacity or speed that he may not be using. Alternatively, a subscriber who tends to be a heavier user and uses his Internet service for more bandwidth-intensive tasks (e.g., online gaming, video voice over Internet protocol (VoIP), etc.) may choose a subscription tier with a higher data transfer rate or bandwidth amount so as to not experience latency.

In many situations, a subscriber's bandwidth usage may elevate to a level higher than typical usage behavior. For example, the subscriber may select to perform a bandwidth-intensive task (e.g., online gaming, streaming content). If the bandwidth utilization exceeds a predetermined threshold, a data transfer rate may be perceived as slow, and may cause user frustration. Additionally, some subscribers may be unaware of what activities may be bandwidth-intensive. While the transfer speed offered with his current subscription tier may be adequate for the user's normal use, a higher performance speed may be desirable for a higher quality experience for the bandwidth-intensive task.

It is with respect to these and other considerations that the present invention has been made.

### SUMMARY

Embodiments of the present invention provide a recommendation notification to a subscriber to increase an amount of bandwidth available to the subscriber's network service account. Utilization of bandwidth may be monitored. When the utilization of bandwidth exceeds a predetermined threshold, a subscriber's data transfer rate may be perceived as slow or incapable of handling the data being transferred. A recommendation may be provided to notify the subscriber of temporary bandwidth upgrade options. The recommendation may be in the form of a text message, an email, a pop-up window, a selectable user interface control, or other notification method.

The details of one or more embodiments are set forth in the accompanying drawings and description below. Other fea-

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tures and advantages will be apparent from a reading of the following detailed description and a review of the associated drawings. It is to be understood that the following detailed description is explanatory only and is not restrictive of the invention as claimed.

### BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings in which like reference numbers represent corresponding parts throughout:

FIG. 1 is a diagram of an exemplary system for providing additional bandwidth according to an embodiment;

FIG. 2 is an illustration of an example of an additional bandwidth recommendation notification displayed on an end-point device;

FIG. 3 is an illustration of an example of an additional bandwidth recommendation notification sent as a text message to a mobile communication device;

FIG. 4 is an illustration of an example of an additional bandwidth recommendation notification provided via a third party application;

FIG. 5 is a flow chart of a method for providing an additional bandwidth recommendation notification according to an embodiment;

FIG. 6 is a block diagram illustrating example physical components of a computing device with which embodiments may be practiced;

FIGS. 7A-7B illustrate a suitable mobile computing environment with which embodiments may be practiced; and

FIG. 8 is a simplified block diagram illustrating a cable television services system architecture providing an operating environment according to an embodiment.

### DETAILED DESCRIPTION

Embodiments may provide for determining a minimum data transfer rate needed to effectively perform a data transfer activity. If the minimum data transfer rate needed to effectively perform the activity is greater than the amount of bandwidth available according to an associated subscription tier, a notification may be provided to a subscriber that a bandwidth adjustment is available and may be desirable for a better quality experience of the data transfer activity. The notification may include a selectable functionality, which when selected, may send a request to adjust the amount of bandwidth available to the subscriber.

These embodiments may be combined, other embodiments may be utilized, and structural changes may be made without departing from the spirit or scope of the present invention. The following detailed description is therefore not to be taken in a limiting sense, and the scope of the present invention is defined by the appended claims and their equivalents. Referring now to the drawings, in which like numerals refer to like elements throughout the several figures, embodiments of the present invention and an exemplary operating environment will be described.

FIG. 1 is a simplified block diagram illustrating a system 100 for providing adjustable bandwidth. As illustrated in FIG. 1, a variety of endpoint devices 108, 110, 112, 114, 116, 118 may connect via various types of network architectures 104 (e.g., hybrid fiber coax (HFC), digital subscriber line (DSL), mobile network, etc.) to access an IP-based network 120 such as the Internet. Endpoint devices may include, but are not limited to, a computing device 108, a mobile communication device 110, a voice over Internet protocol (VoIP) phone 112, a tablet computing device 114, an Internet television 116, or a television connected to a networked device, such as a set top

box (STB) **118**. The system **100** may include a gateway device **102** (e.g., modem) for connecting one or more end-point devices **108, 110, 112, 114, 116, 118** to a network **104, 120**. A variety of services may be provided through a network **104, 120** including, for example, traditional digital and analog video programming, telephone services, high speed Internet access, video-on-demand, and information services. Services may be provided or distributed by a service provider head end **150**. For example, the head end **150** may include an Internet service provider (ISP), CATV services provider, cellular services provider, etc. operable to data (e.g., video programming, telephone services, multimedia messages, Internet data, etc.) downstream to an endpoint device and receive data upstream from an access device or gateway device **102**.

According to embodiments, the system **100** may include a bandwidth manager module **175** operable to adjust an amount of bandwidth available to a subscriber network access connection. The available bandwidth may be adjusted via various methods that may alter an upper boundary of a data transfer rate for an access connection. An altering of the upper boundary of the data transfer rate may be an override sent to a gateway device **102**. According to an embodiment, the bandwidth manager module **104** may be further operable to determine if a bandwidth increase may be advantageous for a data transfer activity and accordingly provide a notification to a subscriber of a recommendation to adjust the bandwidth associated with a subscription. The bandwidth increase may be a temporary adjustment, for example, an increased bandwidth for an allotted amount of time to perform a bandwidth-intensive activity. The bandwidth manager module **175** may be located at a service provider head end **150**, or may be located remotely and accessed by the head end **150** via a network, such as IP-based network **120**.

A subscriber may be charged a fee for a bandwidth increase. According to an embodiment, a bandwidth increase fee may be calculated according to an amount of additional bandwidth and a time duration of the additional bandwidth. When a request to increase a data transfer rate is sent to a gateway device **102**, a notification of the bandwidth increase may be provided to a billing system **162** associated with the service subscription such that a subscriber's account may be charged for the service upgrade.

According to one embodiment, bandwidth adjustment may be provided for a selected time period. For example, a subscriber may select to increase his bandwidth to a next available service tier for one hour, two hours, one day, one week, etc. Accordingly, the billing system **162** may receive a notification of the bandwidth increase for the selected time period and may apply a fee to an associated subscriber for the selected additional bandwidth amount and for the selected time period. According to another embodiment, a subscriber's subscription may remain at an increased bandwidth tier until the subscriber selects to readjust or decrease his available bandwidth. Accordingly, the subscriber may be charged an amount according to his subscription tier and may be charged an additional amount for the time period of the increased bandwidth. For example, if a user selects to increase his bandwidth halfway through a billing cycle and does not readjust his bandwidth amount until the end of the billing cycle, the subscriber may be billed at a first rate for the first half of the billing cycle and may be billed at a second higher rate for the second half of the billing cycle.

As described briefly above, embodiments may provide for determining a minimum data transfer rate needed to effectively perform a data transfer activity and providing a notification to a subscriber if the minimum data transfer rate

needed to effectively perform the activity exceeds the amount of bandwidth available according to an associated subscription tier. According to one embodiment, data usage and bandwidth percentage may be calculated and monitored. Monitoring bandwidth usage may include determining an elevated level of bandwidth usage. For example, if a subscriber has a subscription with 3 Mbps of bandwidth and has selected to upload 100 photographs to an online photo sharing website, the percentage of bandwidth being used to perform the upload may be calculated. If a task (e.g., the upload of photographs) is consuming a predetermined percentage of bandwidth capacity (e.g., exceeding a bandwidth utilization threshold), a notification may be provided.

According to another embodiment, a roundtrip method may be utilized to determine a potential need for additional bandwidth. For example, if a time it takes a given network pack to travel from its source to its destination (e.g., endpoint device **108, 110, 112, 114, 116, 118** or gateway device **102**) and back exceeds a predetermined threshold, a notification may be provided.

According to another embodiment, a subscriber's profile may be monitored for usage patterns. For example, a subscriber's usage pattern may indicate that a large amount of bandwidth is utilized during the times of 5:00 PM to 9:00 PM. Accordingly, upon detection of a peak bandwidth usage time, a notification may be provided.

According to another embodiment, data packet types may be inspected. For example, data packets may be analyzed for certain types of data, such as movies, games, etc. If a detection is made of a transfer of certain types of data packets that may be determined as bandwidth-intensive, a notification may be provided.

According to embodiments, various types of notifications may be provided. For example, a notification of a recommendation for a bandwidth increase may be provided as a text message, an email message, a pop-up window, or a selectable functionality control displayed in a user interface, in an application window, or on a web page.

Referring to FIG. 2, an example of a notification **202** is illustrated. According to the example illustrated in FIG. 2, a subscriber may access a website **218**, for example, a website offering movie downloads, and may select content, such as a movie **214** to download. Bandwidth monitoring may be performed, wherein a percentage of usage of available bandwidth associated with a communication path to a network access device or gateway device **102** or a rate of data transfer may be calculated. According to one embodiment, bandwidth monitoring may be performed by the bandwidth manager module **175**. According to another embodiment, bandwidth monitoring may be performed by an application on the network access device or gateway device **102**. According to yet another embodiment, bandwidth monitoring may be performed by a remote application and communicated to a gateway device **102**, a head end **150**, a bandwidth manager module **175** or to a third party application, for example, a third party application associated with the website offering movie downloads. According to a determined available bandwidth amount and/or a data transfer rate, an estimated data transfer time **216** may be calculated. A determination may be made to determine if additional bandwidth may be available to a subscriber such that the data transfer rate may be increased.

If a percentage utilization of available bandwidth exceeds a predetermined threshold, if a percentage of data allowance is exceeded, or if a rate of data transfer is below a predetermined threshold and if additional bandwidth or a higher data transfer rate is available, as illustrated in FIG. 2, a notification **202** may be presented. The notification **202** may be provided

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by the service provider (head end **150** or bandwidth manager module **175**), the gateway device **102**, or by a third party application. In this example, the notification **202** may be presented in the form of a pop-up window **204** and may include an estimated data transfer time **216**. The notification **202** may include an interface for allowing a subscriber to select and purchase additional bandwidth for an increased data transfer rate. For example, the notification **202** may provide one or more data transfer rate options **206**. Each data transfer rate option **206** may be associated with a service tier. A transfer rate selection **206** data transfer rate option may include an estimated data transfer time **216**. The notification **202** may also include a selectable duration **208** for the increased bandwidth adjustment. For example, the subscriber may select a number of hours, days, weeks, or for a permanent bandwidth increase. An associated fee **210** may be provided, as well as a selectable user interface element **212** for completing the request for increased bandwidth.

Referring now to FIG. 3, a notification **202** in the form of a text message **304** sent to a mobile communication device **110** is illustrated. Like in the example described in FIG. 2, bandwidth monitoring may be performed and a determination of availability of additional bandwidth may be made. As illustrated, progress of a data transfer activity may be displayed, for example, via a progress bar **302** and/or as a percent completion of the data transfer activity. According to embodiments, if a percentage utilization of available bandwidth exceeds a predetermined threshold or if a rate of data transfer is below a predetermined threshold and if additional bandwidth or a higher data transfer rate is available, as illustrated in FIG. 3, a notification **202** in the form of a text message **304** may be presented. For example the text message **304** notification **202** may be sent to a mobile communication device **110** associated with a subscriber requesting the data transfer activity. The text message **304** notification **202** may include an estimated data transfer time **216** and an option **306** for requesting increased bandwidth. For example, a reply to the text message may send a request to the bandwidth manager module **175** to increase the subscriber's bandwidth amount.

As illustrated in FIG. 4, a notification **202** may be provided via a third party application. For example, a subscriber may utilize a third party application (e.g., online photo management application **412**) for storing photographs on a remote server. The third party application may communicate with the subscriber's service provider's head end **150** and/or bandwidth manager module **175** to determine bandwidth usage, capacity, and availability. The third party application may also communicate with the subscriber's service provider's head end **150** and/or bandwidth manager module **175** to provide various selectable bandwidth increase options **206** and fees **210** associated with the various options **206**. The bandwidth increase options **206** may or may not include selectable time durations of bandwidth increase. The notification **202** may include a selectable user interface element **212** for requesting a selected bandwidth increase option **206**.

Having described a system architecture **100** and various examples of bandwidth increase notifications, FIG. 5 is a flow chart of a method **500** for providing a recommendation to increase bandwidth. The method **500** starts at OPERATION **502** and proceeds to OPERATION **504** where bandwidth utilization may be monitored. According to one embodiment, a subscriber's bandwidth usage levels may be monitored and tracked, for example, to generate a subscriber usage profile. According to another embodiment, a time taken by a data packet to transverse a path from a source to its destination and back may be measured. According to another embodiment, data packets may be inspected for types of data packets that

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may require more bandwidth than other types, for example, a transfer of video data packets.

At DECISION OPERATION **506**, a determination may be made to determine if additional bandwidth may be useful for performing a data transfer activity. For example, a data transfer activity may include transmitting a digital bit stream of data (e.g., web pages, text, images, video, audio, applications, compressed files, etc.) over a point-to-point or a multipoint communication channel. According to one embodiment, if performing a data transfer activity causes a predetermined bandwidth utilization threshold to be exceeded, a determination may be made that additional bandwidth may be useful for performing the data transfer activity. The bandwidth utilization threshold may be assessed according to a bandwidth amount allowed to a subscriber's account per his service tier and a percentage usage of the bandwidth amount for providing a minimal latency transfer rate of data. For example if a subscriber's usage of bandwidth elevates to a high level, his Internet speed or data transfer rate may be perceived as slow or incapable of handling the data being read. According to another embodiment, a determination may be made that additional bandwidth may be useful for performing a data transfer activity according to the data transfer activity or during a certain time period according to a subscriber's usage profile.

If a determination is made at DECISION OPERATION **506** that additional bandwidth may be useful for performing a data transfer activity, the method **500** proceeds to DECISION OPERATION **508** to determine if additional bandwidth capacity is available for utilization by the subscriber. For example, if a service provider provides three tiers of broadband service, wherein a first tier may provide a data transfer rate of 375 Kbps, a second tier may provide a data transfer rate of 3.75 Mbps, and a third tier may provide a data transfer rate of 12.5 Mbps, and a subscriber is subscribed to the third tier with a data transfer rate of 12.5 Mbps, additional bandwidth may not be available. However, if a subscriber subscribes to the first service tier, additional bandwidth may be available to increase his bandwidth capacity to the next available service tier (e.g., data transfer rate of 3.75 Mbps). Additionally, bandwidth may be shared with other subscribers. If a data transfer activity is occurring during a peak usage time, additional bandwidth may not be available to allocate to a subscriber.

If additional bandwidth is available, the method **500** may proceed to OPERATION **510** where a notification **202** may be provided to the subscriber as a recommendation to upgrade his data transfer rate. As described above, a notification **202** may be provided in various forms and may include various service options (e.g., available data transfer rates **206** and/or available upgrade durations **208**) and/or a selectable user interface element **212** for selecting to increase bandwidth. A billing system **162** may be queried for a subscriber's contact information (e.g., phone numbers, email addresses, etc.) and his subscription information (e.g., subscription tier). The method **500** may end at OPERATION **595** or may proceed to a method for receiving a request to increase a subscriber's bandwidth amount.

FIG. 6 is a block diagram illustrating example physical components of a computing device **600** with which embodiments may be practiced. In some embodiments, one or a combination of the components the bandwidth manager module **175** may be implemented using one or more computing devices like the computing device **600**. It should be appreciated that in other embodiments, the bandwidth manager module **175** may be implemented using computing devices having hardware components other than those illustrated in the example of FIG. 6.

Computing devices may be implemented in different ways in different embodiments. For instance, in the example of FIG. 6, the computing device includes a processing system 604, memory 602, a network interface 606, a secondary storage device 608, an input device 610, a video interface 612, a display unit 614, and a communication medium 616. In other embodiments, the computing device 600 may be implemented using more or fewer hardware components (e.g., a video interface, a display unit, or an input device) or in combination with other types of computer systems and program modules.

The memory 602 includes one or more computer-readable storage media capable of storing data and/or computer-executable instructions. According to one embodiment, bandwidth manager module 175 may be stored locally on computing device 600. Memory 602 thus may store the computer-executable instructions that, when executed by processor 604, cause a determination of a need for additional bandwidth and/or a request for additional bandwidth as described above with reference to FIGS. 1-5.

In various embodiments, the memory 602 is implemented in various ways. For example, the memory 602 can be implemented as various types of computer-readable storage media. Example types of computer-readable storage media include, but are not limited to, solid state memory, flash memory, dynamic random access memory (DRAM), double data rate synchronous dynamic random access memory (DDR SDRAM), DDR2 SDRAM, DDR3 SDRAM, read-only memory (ROM), reduced latency DRAM, electrically-erasable programmable ROM (EEPROM), and other types of devices and/or articles of manufacture that store data.

According to embodiments, the term computer-readable media includes communication media and computer-readable storage media. Communication media include information delivery media. Computer-executable instructions, data structures, program modules, or other data in a modulated data signal, such as a carrier wave or other transport mechanism, may be embodied on a communications medium. The term modulated data signal describes a signal that has one or more characteristics set or changed in such a manner as to encode information in the signal. For example, communication media can include wired media, such as a wired network or direct-wired connection, and wireless media, such as acoustic, radio frequency (RF), infrared, and other wireless media.

The term computer-readable storage medium may also refer to devices or articles of manufacture that store data and/or computer-executable instructions readable by a computing device. The term computer-readable storage media encompasses volatile and nonvolatile, removable and non-removable media implemented in various methods or technologies for storage and retrieval of information. Such information can include data structures, program modules, computer-executable instructions, or other data.

The processing system 604 includes one or more processing units, which may include tangible integrated circuits that selectively execute computer-executable instructions. In various embodiments, the processing units in the processing system 604 are implemented in various ways. For example, the processing units in the processing system 604 can be implemented as one or more processing cores. In this example, the processing system 604 can comprise one or more Intel Core microprocessors. In another example, the processing system 604 can comprise one or more separate microprocessors. In yet another example embodiment, the processing system 604 can comprise Application-Specific Integrated Circuits (ASICs) that provide specific functionality. In yet another

example, the processing system 604 provides specific functionality by using an ASIC and by executing computer-executable instructions.

The computing device 600 may be enabled to send data to and receive data from a communication network via a network interface card 606. In different embodiments, the network interface card 606 is implemented in different ways, such as an Ethernet interface, a token-ring network interface, a fiber optic network interface, a wireless network interface (e.g., Wi-Fi, Wi-Max, etc.), or another type of network interface. The network interface may allow the device to communicate with other devices, such as over a wireless network in a distributed computing environment, a satellite link, a cellular link, and comparable mechanisms. Other devices may include computer device(s) that execute communication applications, storage servers, and comparable devices.

The secondary storage device 608 includes one or more computer-readable storage media, and may store data and computer-executable instructions not directly accessible by the processing system 604. That is, the processing system 604 performs an I/O operation to retrieve data and/or computer-executable instructions from the secondary storage device 608. In various embodiments, the secondary storage device 608 can be implemented as various types of computer-readable storage media, such as by one or more magnetic disks, magnetic tape drives, CD-ROM discs, DVD-ROM discs, BLU-RAY discs, solid state memory devices, and/or other types of computer-readable storage media.

The input device 610 enables the computing device 600 to receive input from a user. Example types of input devices include, but are not limited to, keyboards, mice, trackballs, stylus input devices, key pads, microphones, joysticks, touch-sensitive display screens, and other types of devices that provide user input to the computing device 600.

The video interface 612 outputs video information to the display unit 614. In different embodiments, the video interface 612 is implemented in different ways. For example, the video interface 612 is a video expansion card. In another example, the video interface 612 is integrated into a motherboard of the computing device 600. In various embodiments, the display unit 614 can be an LCD display panel, a touch-sensitive display panel, an LED screen, a projector, a cathode-ray tube display, or another type of display unit. In various embodiments, the video interface 612 communicates with the display unit 614 in various ways. For example, the video interface 612 can communicate with the display unit 614 via a Universal Serial Bus (USB) connector, a VGA connector, a digital visual interface (DVI) connector, an S-Video connector, a High-Definition Multimedia Interface (HDMI) interface, a DisplayPort connector, or another type of connection.

The communications medium 616 facilitates communication among the hardware components of the computing device 600. In different embodiments, the communications medium 616 facilitates communication among different components of the computing device 600. For instance, in the example of FIG. 6, the communications medium 616 facilitates communication among the memory 602, the processing system 604, the network interface card 606, the secondary storage device 608, the input device 610, and the video interface 612. In different embodiments, the communications medium 616 is implemented in different ways, such as a PCI bus, a PCI Express bus, an accelerated graphics port (AGP) bus, an Infiniband interconnect, a serial Advanced Technology Attachment (ATA) interconnect, a parallel ATA interconnect, a Fiber Channel interconnect, a USB bus, a Small Computing system Interface (SCSI) interface, or another type of communications medium.

The memory **602** stores various types of data and/or software instructions. For instance, in the example of FIG. **6**, the memory **602** stores a Basic Input/Output System (BIOS) **618**, and an operating system **620**. The BIOS **618** includes a set of software instructions that, when executed by the processing system **604**, cause the computing device **600** to boot up. The operating system **620** includes a set of software instructions that, when executed by the processing system **604**, cause the computing device **600** to provide an operating system that coordinates the activities and sharing of resources of the computing device **600**. The memory **602** also stores one or more application programs **622** that, when executed by the processing system **604**, cause the computing device **600** to provide applications to users, for example, the bandwidth manager module **175**. The memory **602** also stores one or more utility programs **624** that, when executed by the processing system **604**, cause the computing device **600** to provide utilities to other software programs. Embodiments of the present invention may be utilized in various distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network in a distributed computing environment.

FIGS. **7A-7B** illustrate a suitable mobile computing environment, for example, a mobile computing device **700**, a smart phone, a tablet personal computer, a laptop computer, and the like, with which embodiments may be practiced. The mobile computing device **700** is illustrative of any suitable device operative to send, receive and process wireless communications according to embodiments of the present invention. A display screen **705** is operative for displaying a variety of information such as information about incoming and outgoing communications, as well as, a variety of data and displayable objects, for example, text, alphanumeric data, photographs, and the like.

Data input to the device **700** may be performed via a variety of suitable means, such as, touch screen input via the display screen **705**, keyboard or keypad input via a data entry area **710**, key input via one or more selectable buttons or controls **715**, voice input via a microphone **718** disposed on the device **700**, photographic input via a camera **725** functionality associated with the mobile computing device, or any other suitable input means. Data may be output via the device **700** via any suitable output means, including but not limited to, display on the display screen **705**, audible output via an associated speaker **730** or connected earphone system, vibration module for providing tactile output, and the like.

Referring now to FIG. **7B**, operational unit **735** is illustrative of internal operating functionality of the mobile computing device **700**. A processor **740** is illustrative of a general purpose computer processor for processing incoming and outgoing data and communications and controlling operation of the device and associated software applications via a mobile computing device operating system. Memory **745** may be utilized for storing a device operating system, device programming, one or more stored applications, for example, mobile telephone applications, data processing applications, calculators, games, Internet browsing applications, navigation applications, acceleration applications, camera and/or video applications, etc. According to one embodiment, one or more components of the bandwidth manager module **175** may be stored locally on mobile computing device **700**.

Mobile computing device **700** may contain an accelerometer **755** for detecting acceleration, and can be used to sense orientation, vibration, and/or shock. Mobile computing device **700** may contain a global positioning system (GPS) system (e.g., GPS send/receive functionality) **760**. A GPS system **760** uses radio waves to communicate with satellites

orbiting the Earth. Some GPS-enabled mobile computing devices use wireless-assisted GPS to determine a user's location, wherein the device uses orbiting GPS satellites in conjunction with information about the device's mobile phone signal. Radio functions **750** include all required functionality, including onboard antennae, for allowing the device **700** to communicate with other communication devices and systems via a wireless network. Radio functions **750** may be utilized to communicate with a wireless or WIFI-based positioning system to determine a device's **700** location.

FIG. **8** is a simplified block diagram illustrating a cable television services system **800** (hereafter referred to as "CATV") architecture providing an operating environment according to an embodiment. As can be appreciated, a CATV architecture is but one of various types of systems that may be utilized to provide additional bandwidth. Referring now to FIG. **8**, digital and analog video programming, information content and interactive television services are provided via a hybrid fiber coax (HFC) network **815** to a television set **116** for consumption by a cable television/services system customer. As is known to those skilled in the art, HFC networks **815** combine both optical fiber and coaxial cable lines. Typically, optical fiber runs from the cable head end **150** to neighborhoods of subscribers. Coaxial cable runs from the optical fiber feeders to each customer or subscriber. The functionality of the HFC network **815** allows for efficient bidirectional data flow between the client-side set-top box **118** and a server-side application server **840**.

The CATV system **800** is in the form of a distributed client-server computing system for providing video and data flow across the HFC network **815** between server-side services providers (e.g., cable television/services providers) via a server-side head end **150** and a client-side customer via a client-side set-top box (STB) **118** functionally connected to a customer receiving device, such as the television set **116**. As is understood by those skilled in the art, modern CATV systems **800** may provide a variety of services across the HFC network **815** including traditional digital and analog video programming, telephone services, high speed Internet access, video-on-demand, and information services.

On the client side of the CATV system **800**, digital and analog video programming and digital and analog data are provided to the customer television set **116** via the set-top box (STB) **118**. Interactive television services that allow a customer to input data to the CATV system **800** likewise are provided by the STB **118**. As illustrated in FIG. **8**, the STB **118** is a multipurpose computing device having a computer processor, memory, and an input/output mechanism. The input/output mechanism receives input from server-side processes via the HFC network **815** and from customers via input devices such as the remote control device **828**, keyboard **830**, or other computing device, such as a tablet/slate computer **114**, smart phone **110**, etc. The remote control device **828** and the keyboard **830** may communicate with the STB **118** via a suitable communication transport such as the infrared connection **832**. The STB **118** also includes a video processor for processing and providing digital and analog video signaling to the television set **116** via a cable communication transport **834**. A multi-channel tuner is provided for processing video and data to and from the STB **118** and the server-side head end system **150**, described below.

The STB **118** also includes an operating system **822** for directing the functions of the STB **118** in conjunction with a variety of client applications **825**. For example, if a client application **825** requires a news flash from a third-party news source to be displayed on the television **116**, the operating system **822** may cause the graphics functionality and video

processor of the STB **118**, for example, to output the news flash to the television **116** at the direction of the client application **825** responsible for displaying news items. According to embodiments, the operating system **822** may include the bandwidth manager module **175** as described herein.

Because a variety of different operating systems **822** may be utilized by a variety of different brands and types of set-top boxes, a middleware layer **824** may be provided to allow a given software application to be executed by a variety of different operating systems. According to an embodiment, the middleware layer **824** may include a set of application programming interfaces (APIs) that are exposed to client applications **825** and operating systems **822** that allow the client applications to communicate with the operating systems through common data calls understood via the API set. As described below, a corresponding middleware layer is included on the server side of the CATV system **800** for facilitating communication between the server-side application server and the client-side STB **118**. The middleware layer **842** of the server-side application server and the middleware layer **824** of the client-side STB **118** may format data passed between the client side and server side according to the Extensible Markup Language (XML).

According to one embodiment, the set-top box **118** passes digital and analog video and data signaling to the television **116** via a one-way communication transport **834**. According to other embodiments, two-way communication transports may be utilized, for example, via high definition multimedia (HDMI) ports. The STB **118** may receive video and data from the server side of the CATV system **800** via the HFC network **815** through a video/data downlink and data via a data downlink. The STB **118** may transmit data from the client side of the CATV system **800** to the server side of the CATV system **800** via the HFC network **815** via one data uplink. The video/data downlink is an "in band" downlink that allows for digital and analog video and data signaling from the server side of the CATV system **800** through the HFC network **815** to the set-top box **118** for use by the STB **118** and for distribution to the television set **116**. As is understood by those skilled in the art, the "in band" signaling space operates at a relative high frequency, e.g., between 54 and 1000 megahertz. The signaling space is generally divided into 6 megahertz channels in which may be transmitted as a single analog signal or a greater number (e.g., ten) of digital signals.

The data downlink and the data uplink, illustrated in FIG. **8**, between the HFC network **815** and the set-top box **118** comprise "out of band" data links. As is understood by those skilled in the art, the "out of band" frequency range is generally at a lower frequency than "in band" signaling. For example, the "out of band" frequency range may be between zero and 54 megahertz. Data flow between the client-side set-top box **118** and the server-side application server **840** is typically passed through the "out of band" data links. Alternatively, an "in band" data carousel may be positioned in an "in band" channel into which a data feed may be processed from the server-side application server **840** through the HFC network **815** to the client-side STB **118**. Operation of data transport between components of the CATV system **800**, described with reference to FIG. **8**, is well known to those skilled in the art.

Referring still to FIG. **8**, the head end **150** of the CATV system **800** is positioned on the server side of the CATV system and includes hardware and software systems responsible for originating and managing content for distributing through the HFC network **815** to client-side STBs **118** for presentation to customers via televisions **116**. As described above, a number of services may be provided by the CATV

system **800**, including digital and analog video programming, interactive television services, telephone services, video-on-demand services, targeted advertising, and provision of information content.

The application server **840** is a general-purpose computing system operative to assemble and manage data sent to and received from the client-side set-top box **118** via the HFC network **815**. As described above with reference to the set-top box **118**, the application server **840** includes a middleware layer **842** for processing and preparing data from the head end of the CATV system **800** for receipt and use by the client-side set-top box **118**. For example, the application server **840** via the middleware layer **842** may obtain data from third-party services **846** via the Internet **120** for transmitting to a customer through the HFC network **815** and the set-top box **118**. For example, content metadata a third-party content provider service may be downloaded by the application server via the Internet **120**. When the application server **840** receives the downloaded content metadata, the middleware layer **842** may be utilized to format the content metadata for receipt and use by the set-top box **118**. Therefore, content metadata may be sent and categorized based on the availability to the customer's program guide data.

According to one embodiment, data obtained and managed by the middleware layer **842** of the application server **840** is formatted according to the Extensible Markup Language and is passed to the set-top box **118** through the HFC network **815** where the XML-formatted data may be utilized by a client application **825** in concert with the middleware layer **824**, as described above. As should be appreciated by those skilled in the art, a variety of third-party services data, including news data, weather data, sports data and other information content may be obtained by the application server **840** via distributed computing environments such as the Internet **120** for provision to customers via the HFC network **815** and the set-top box **118**.

According to embodiments, the application server **840** obtains customer support services data, including billing data, information on customer work order status, answers to frequently asked questions, services provider contact information, and the like from data services **860** for provision to the customer via an interactive television session. As illustrated in FIG. **8**, the services provider data services **860** include a number of services operated by the services provider of the CATV system **800** which may include data on a given customer.

A billing system **162** may include information such as a customer's name, street address, business identification number, Social Security number, credit history, and information regarding services and products subscribed to by the customer. According to embodiments, the billing system **162** may also include billing data for services and products subscribed to by the customer for bill processing, billing presentment and payment receipt.

A customer information database **868** may include general information about customers such as place of employment, business address, business telephone number, and demographic information such as age, gender, educational level, and the like. The customer information database **868** may also include information on pending work orders for services or products ordered by the customer. The customer information database **868** may also include general customer information such as answers to frequently asked customer questions and contact information for various service provider offices/departments. As should be understood, this information may be stored in a variety of disparate databases operated by the cable services provider.



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Referring still to FIG. 8, web services system **850** is illustrated between the application server **840** and the data services **860**. According to embodiments, web services system **850** serves as a collection point for data requested from each of the disparate data services systems comprising the data services **860**. According to embodiments, when the application server **840** requires customer services data from one or more of the data services **860**, the application server **840** passes a data query to the web services system **850**. The web services system formulates a data query to each of the available data services systems for obtaining any required data for a requesting customer as identified by a set-top box identification associated with the customer. The web services system **850** serves as an abstraction layer between the various data services systems and the application server **840**. That is, the application server **840** is not required to communicate with the disparate data services systems, nor is the application server **840** required to understand the data structures or data types utilized by the disparate data services systems. The web services system **850** is operative to communicate with each of the disparate data services systems for obtaining necessary customer data. The customer data obtained by the web services system is assembled and is returned to the application server **840** for ultimate processing via the middleware layer **842**, as described above.

An authentication system **866** may include information such as secure user names, subscriber profiles, subscriber IDs, and passwords utilized by customers for access to network services. As should be understood by those skilled in the art, the disparate systems **162**, **864**, **866**, **868** may be integrated or provided in any combination of separate systems, wherein FIG. 8 shows only one example.

Embodiments the invention may be used in combination with any number of computer systems, such as in desktop environments, laptop or notebook computer systems, multiprocessor systems, micro-processor based or programmable consumer electronics, networked PCs, mini computers, main frame computers, mobile communication device systems and the like. Embodiments of the present invention may be utilized in various distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network in a distributed computing environment, and where programs may be located in both local and remote memory storage.

Embodiments, for example, are described above with reference to block diagrams and/or operational illustrations of methods, systems, and computer program products according to embodiments. The functions/acts noted in the blocks may occur out of the order as shown in any flowchart or described herein with reference to FIGS. 1-8. For example, two processes shown or described in succession may in fact be executed substantially concurrently or the blocks may sometimes be executed in the reverse order, depending upon the functionality/acts involved.

While certain embodiments have been described, other embodiments may exist. Furthermore, although embodiments have been described as being associated with data stored in memory and other storage mediums, data may also be stored on or read from other types of computer-readable storage media, such as secondary storage devices, like hard disks, floppy disks, a CD-ROM, or other forms of RAM or ROM. Further, the disclosed processes may be modified in any manner, including by reordering and/or inserting or deleting a step or process, without departing from the embodiments.

The foregoing description of the exemplary embodiment of the invention has been presented for the purposes of illustra-

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tion and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not with this detailed description, but rather by the claims appended hereto.

What is claimed:

1. A method for providing a recommendation to increase a data transfer rate, the method comprising:

monitoring a utilization of bandwidth for a network subscription at a gateway device;

determining if the utilization of bandwidth exceeds a predetermined bandwidth utilization threshold;

if the utilization of bandwidth exceeds a predetermined bandwidth utilization threshold, determining if additional bandwidth capacity is available to the gateway device;

if additional bandwidth capacity is available, analyzing for certain types of data that are bandwidth intensive;

if bandwidth intensive data is detected, providing a recommendation notification to a subscriber of the network subscription via the gateway device to temporarily increase the amount of bandwidth associated with the network subscription to increase the data transfer rate; and

in response to providing the recommendation notification to the subscriber via the gateway device, providing a user interface with multiple data transfer rate options selectable by the subscriber for additional bandwidth and with multiple time durations selectable by the subscriber for a selected data transfer rate.

2. The method of claim 1, wherein monitoring the utilization of bandwidth for a network subscription comprises monitoring a utilization of bandwidth during a data transfer activity.

3. The method of claim 2, wherein monitoring the utilization of bandwidth during a data transfer activity comprises transmitting a digital bit stream of data over a point-to-point or a multipoint communication channel.

4. The method of claim 3, wherein determining if the utilization of bandwidth exceeds a predetermined bandwidth utilization threshold comprises one or more of:

determining a percentage usage of the amount of bandwidth associated with the network subscription during the data transfer activity exceeds the predetermined threshold;

determining that the data transfer activity includes a bandwidth-intensive data transfer activity; or

determining bandwidth usage during a time period according to a subscriber's usage profile exceeds the predetermined threshold.

5. The method of claim 1, wherein determining if the additional bandwidth capacity is available comprises one or more of:

determining if a next service tier including an additional bandwidth amount is available; or

determining if an amount of bandwidth shared with other subscribers is available to allocate to the subscriber.

6. The method of claim 1, wherein providing the recommendation notification to a subscriber of the network subscription to increase the amount of bandwidth associated with the network subscription to increase the data transfer rate comprises one or more of:

sending a text message to the subscriber's mobile communication device;

sending an email to the subscriber's email account;

displaying a pop-up window; or

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providing a selectable functionality control displayed in one or more of:  
the user interface;  
a third party application window; or  
on a web page.

7. The method of claim 6, further comprising receiving the subscriber's contact information from a billing system.

8. The method of claim 1, wherein providing the recommendation notification to the subscriber of the network subscription to increase the amount of bandwidth associated with the network subscription comprises providing one or more additional bandwidth service tier options.

9. The method of claim 8, further comprising providing a data transfer rate associated with each additional bandwidth service tier option.

10. The method of claim 8, further comprising providing one or more selectable time durations for increasing the amount of bandwidth associated with the network subscription.

11. The method of claim 8, wherein providing one or more additional bandwidth service tier options includes providing one or more selectable user interface elements for purchasing additional bandwidth for an increased data transfer rate.

12. A system for providing a recommendation to increase a data transfer rate, the system comprising:

a memory storage; and  
a processing unit coupled to the memory storage, wherein the processing unit is operable to:  
monitor a utilization of bandwidth for a network subscription;  
determine if the utilization of bandwidth exceeds a predetermined bandwidth utilization threshold;  
if the predetermined bandwidth utilization exceeds the predetermined bandwidth utilization threshold, determine if additional bandwidth capacity is available;  
if additional bandwidth capacity is available, analyze for certain types of data that are bandwidth intensive;  
if bandwidth intensive data is detected, provide a recommendation notification to a subscriber of the network subscription to temporarily increase the amount of bandwidth associated with the network subscription to increase the data transfer rate; and  
in response to providing the recommendation notification to the subscriber, providing a user interface with multiple data transfer rate options selectable by the subscriber for additional bandwidth and with multiple time durations selectable by the subscriber for a selected data transfer rate.

13. The system of claim 12, wherein the processor is further operable to monitor a utilization of bandwidth during a data transfer activity.

14. The system of claim 12, wherein the processor is further operable to determine the utilization of bandwidth exceeds the predetermined bandwidth utilization threshold upon determining one or more of:

a percentage usage of the amount of bandwidth associated with the network subscription during the data transfer activity exceeds the predetermined threshold;  
the data transfer activity includes a bandwidth-intensive data transfer activity; or  
bandwidth usage during a time period according to a subscriber's usage profile exceeds the predetermined threshold.

15. The system of claim 12, wherein the recommendation notification to a subscriber of the network subscription to

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increase the amount of bandwidth associated with the network subscription to increase the data transfer rate comprises one or more of:

a text message to the subscriber's mobile communication device;  
an email to the subscriber's email account;  
a pop-up window; or  
a selectable functionality control displayed in one or more of:  
the user interface;  
an third party application window; or  
on a web page.

16. The system of claim 12, wherein the recommendation notification further comprises providing one or more selectable user interface elements in the user interface for purchasing additional bandwidth for an increased data transfer rate.

17. A computer readable storage device having computer-executable instructions for providing a recommendation to increase a data transfer rate, comprising:

monitoring a utilization of bandwidth for a network subscription during a data transfer activity, wherein the data transfer activity comprises transmitting a digital bit stream of data over a point-to-point or a multipoint communication channel;

determining if the utilization of bandwidth exceeds a predetermined bandwidth utilization threshold by determining one or more of:

a percentage usage of the amount of bandwidth associated with the network subscription during the data transfer activity exceeds the predetermined threshold;  
the data transfer activity includes a bandwidth-intensive data transfer activity; or  
determining bandwidth usage during a time period according to a subscriber's usage profile exceeds the predetermined threshold;

if the utilization of bandwidth exceeds a predetermined bandwidth utilization threshold, determining:

if additional bandwidth capacity is available, analyzing for certain types of data that are bandwidth intensive;

if bandwidth intensive data is detected, providing a recommendation notification to a subscriber of the network subscription to increase the amount of bandwidth associated with the network subscription to increase the data transfer rate, the recommendation notification in the form of one or more of:

a text message to the subscriber's mobile communication device;  
an email to the subscriber's email account;  
a pop-up window; or  
a selectable functionality control; and

the recommendation notification including:

additional bandwidth service tier options;  
a data transfer rate associated with each additional bandwidth service tier option;  
selectable time durations for increasing the amount of bandwidth associated with the network subscription; and  
one or more selectable user interface elements for purchasing additional bandwidth for an increased data transfer rate.

18. A method for providing a recommendation to increase a data transfer rate, the method comprising:

monitoring a utilization of bandwidth for a network subscription;  
determining a usage behavior corresponding with the utilization of bandwidth for the network subscription;

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selecting to perform a task requiring utilization of additional bandwidth that exceeds the bandwidth utilized according to the determined usage behavior;  
determining if the additional bandwidth capacity is available; 5  
if the additional bandwidth capacity is available, analyzing for certain types of data that are bandwidth intensive;  
if bandwidth intensive data is detected, providing a recommendation notification to a subscriber of the network subscription to temporarily increase the amount of bandwidth to include the additional bandwidth in order to complete task; 10  
temporarily increasing the amount of bandwidth to include the additional bandwidth for only as long as it takes to perform the task; and 15  
returning to the bandwidth utilized according to the determined usage behavior as a result of completing the task.

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